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UNIVERSITY



Born in the Wrong Sea...

Lionfish in the (tropical) Western Atlantic



Lad Akins (REEF), Stephanie Green (Simon Fraser University),
James Morris (NOAA), Pam Schofield (USGS)



North Carolina

Pamlico Sound

Bathtown

South Carolina

Charleston

Bermuda

Florida

St. Augustine

Gulf of Mexico

Bahamas

Nassau

New Providence

Strait of Florida

Havana

Cuba

Puerto del Principe

Windward Passage

Tortuga

Cayman Islands

Santiago de Cuba

Santo Domingo

Puerto Rico

St. Thomas

Anguilla

Antigua

St. Kitts Nevis

Guaedelope

Dominica

Martinique

St. Lucia

Barbados

Tobago

Trinidad

Jamaica

Port Royal

Hispaniola

Curocao

Caracus

Venezuela

Caribbean Sea

Mexico

Vera Cruz

Bay of Campeche

Campeche

Belize

Gulf of Honduras

Riohacha

Santa Marta

Cartagena

Maracaibo

Puerto Bello

Nombre de Dios

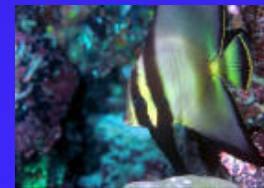
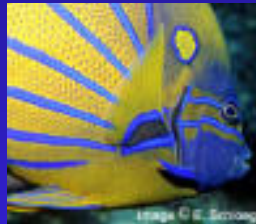
Panama

Pacific Ocean

1992



South Florida marine fish introductions – A unique place....



Lionfish in the Atlantic



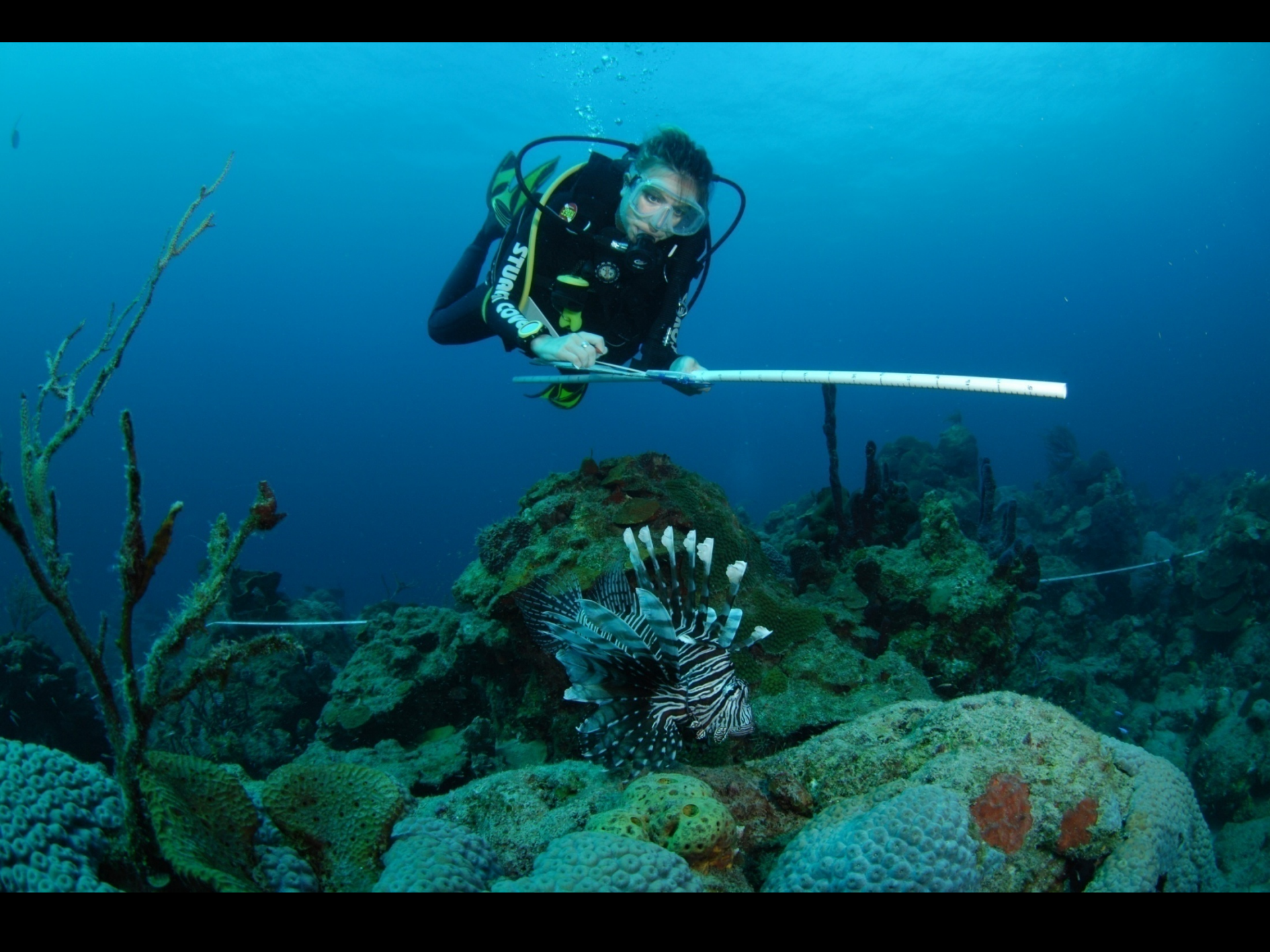




REEF Lionfish Field Operations

- 18 week-long projects throughout the Bahamas, Turks and Caicos and Cayman Islands
- 220+ volunteers
- Collection/documentation – 3000+ specimens to date
- Education/Outreach via talks and media











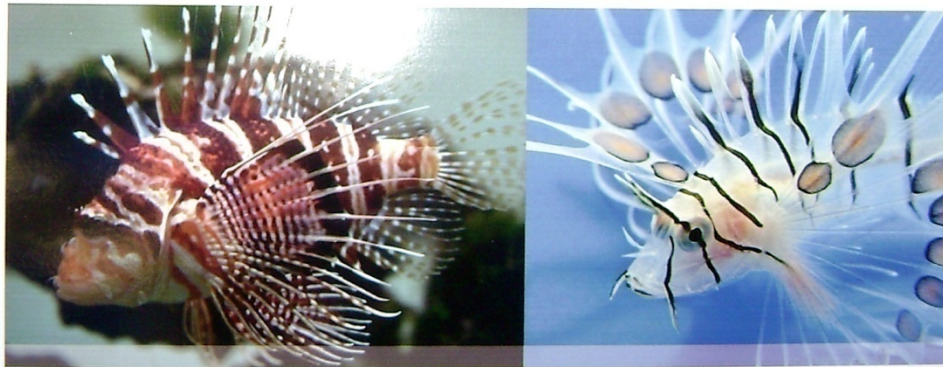




WYNDHAM NASSAU RESORT™
& CRYSTAL PALACE CASINO

WARNING

Lion Fish in area. Do not touch and if sighted report to Towel Booth. If stung or suspicion of stinging occurs, report immediately.



Lion Fish are brightly colored with venomous elongated dorsal fin spines, enlarged pectoral fins and a zebra stripe pattern. The fish tend to not be alarmed by humans, therefore rarely flee from area. If stung by one of the sharp spines a painful puncture will be felt. Rapid swelling will occur and movement of limbs may be difficult. Fatalities are rare, but can occur if not treated.



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Collection and handling...

a very tricky business!









Western Atlantic Sizes

Smallest collected = 28mm

Largest collected = 474mm

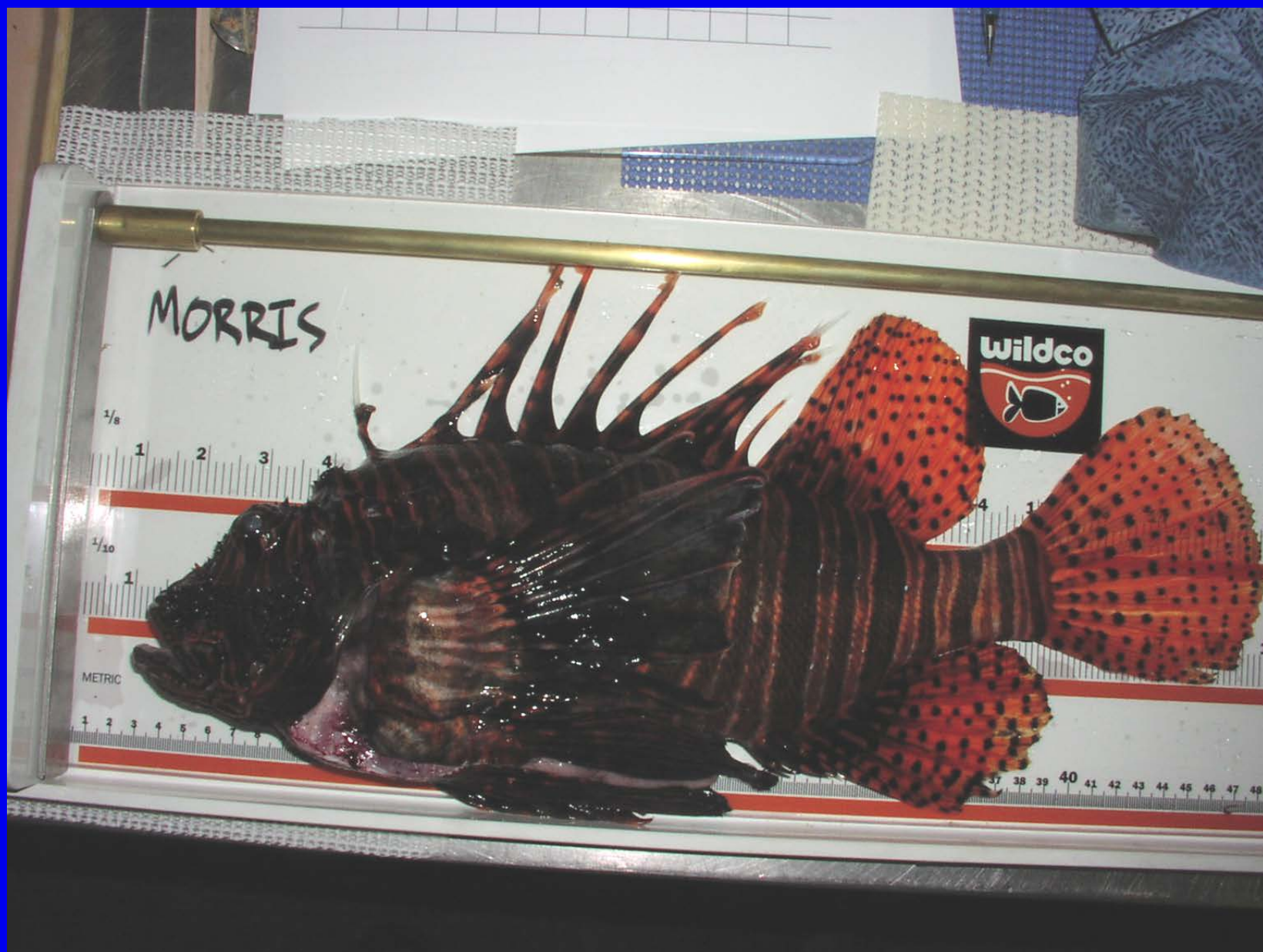
Max size in native range ~ 320-350mm



REEF



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Early tagging data

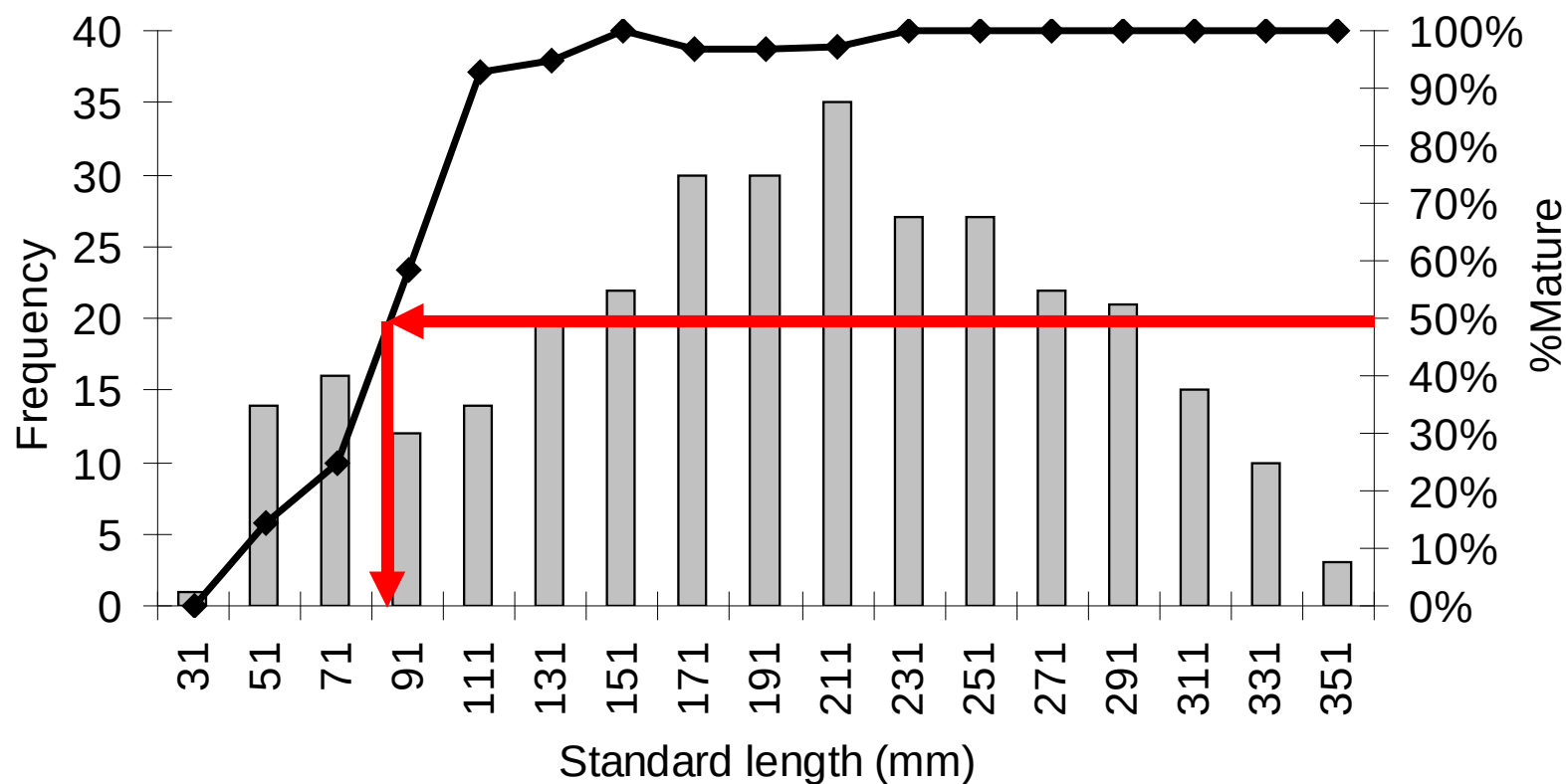
- 86 fish tagged
- 14 recovered, 16 sighted
- 30 days – 7 months after tagging
- All at same dive sites
- Growth rates up to ~ 20cm/yr



Dissection

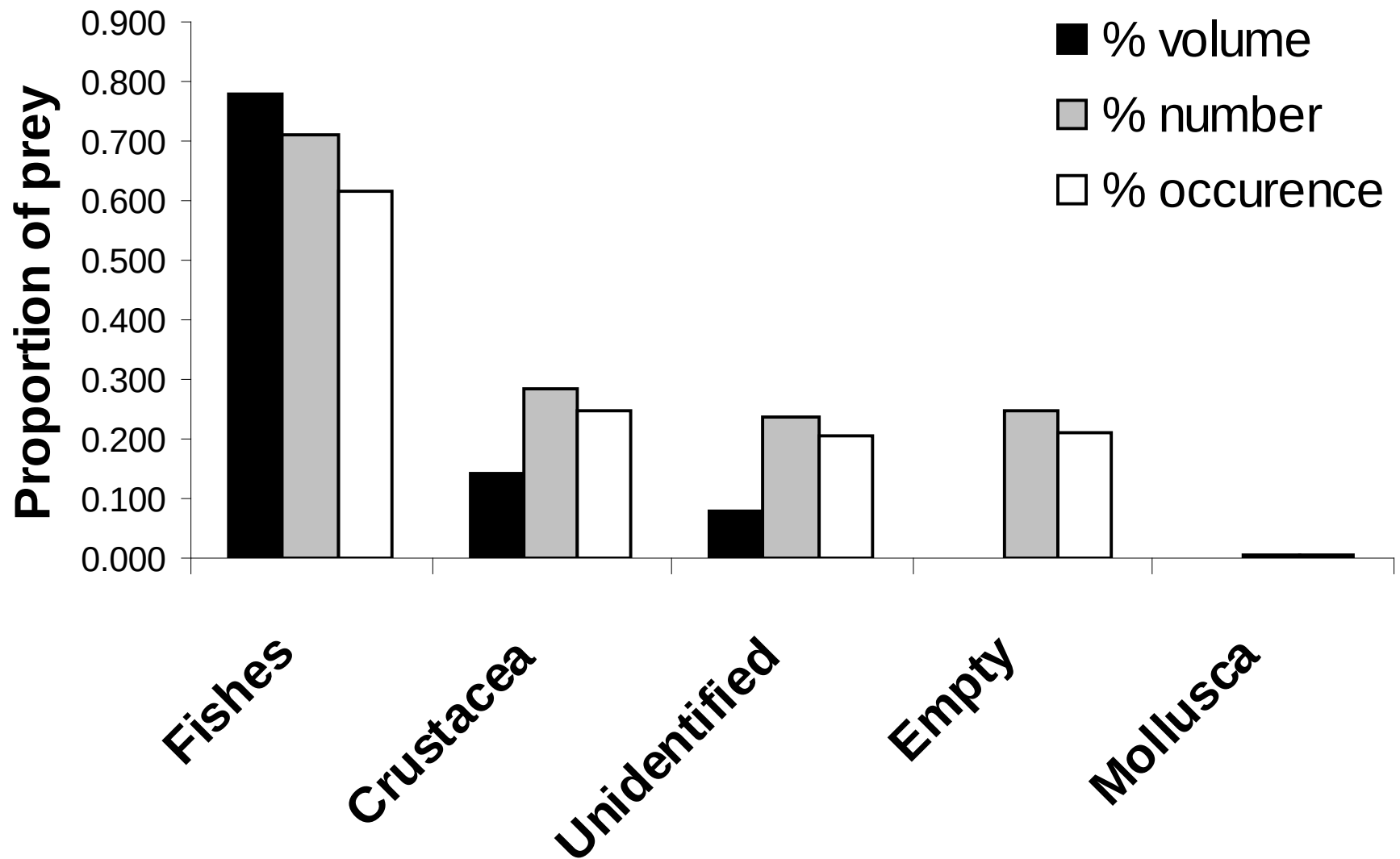


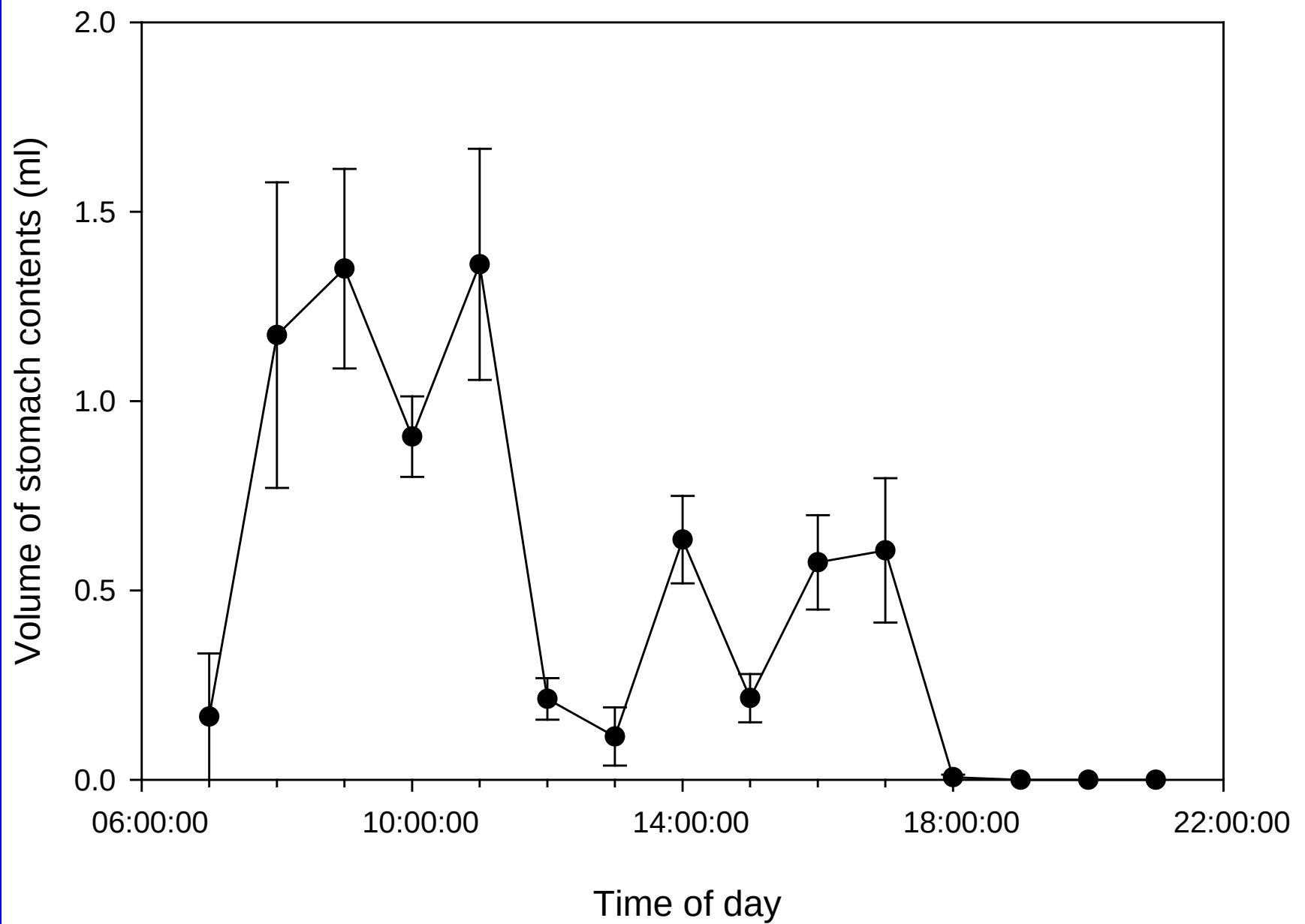
Lionfish male length at maturity (n=319)

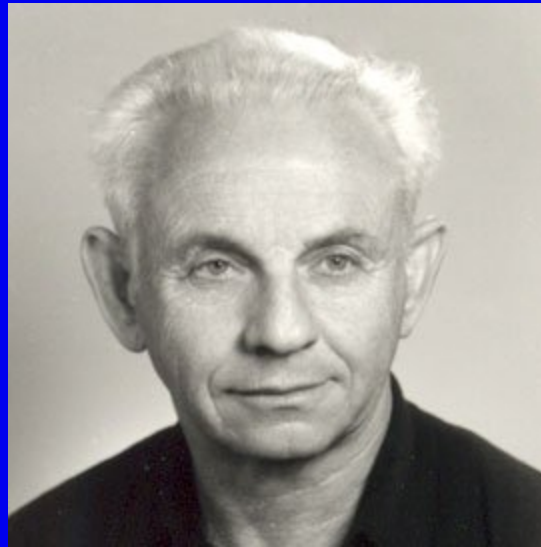


Lionfish stomach content analyses





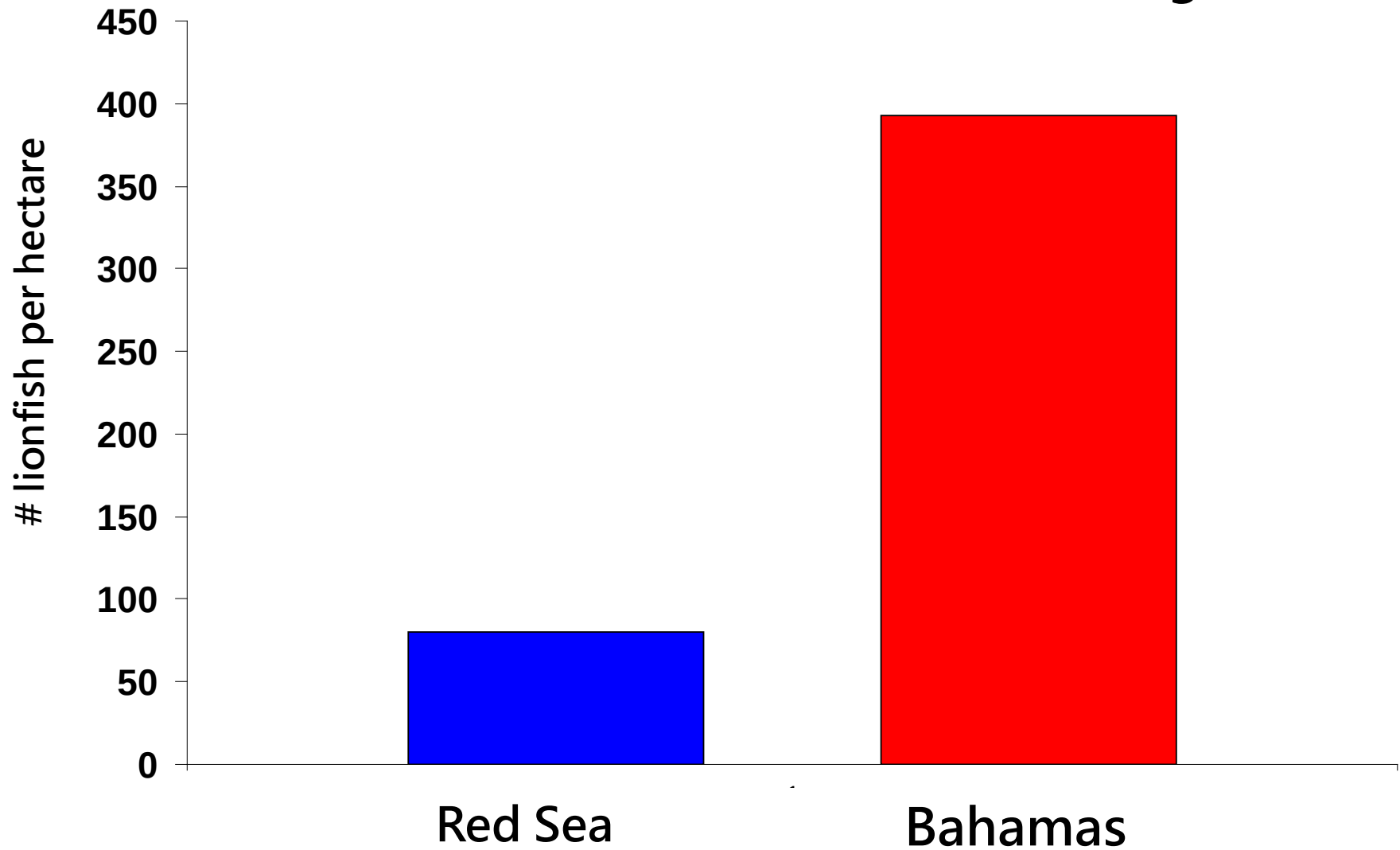




Lev Fishelson, Tel Aviv University

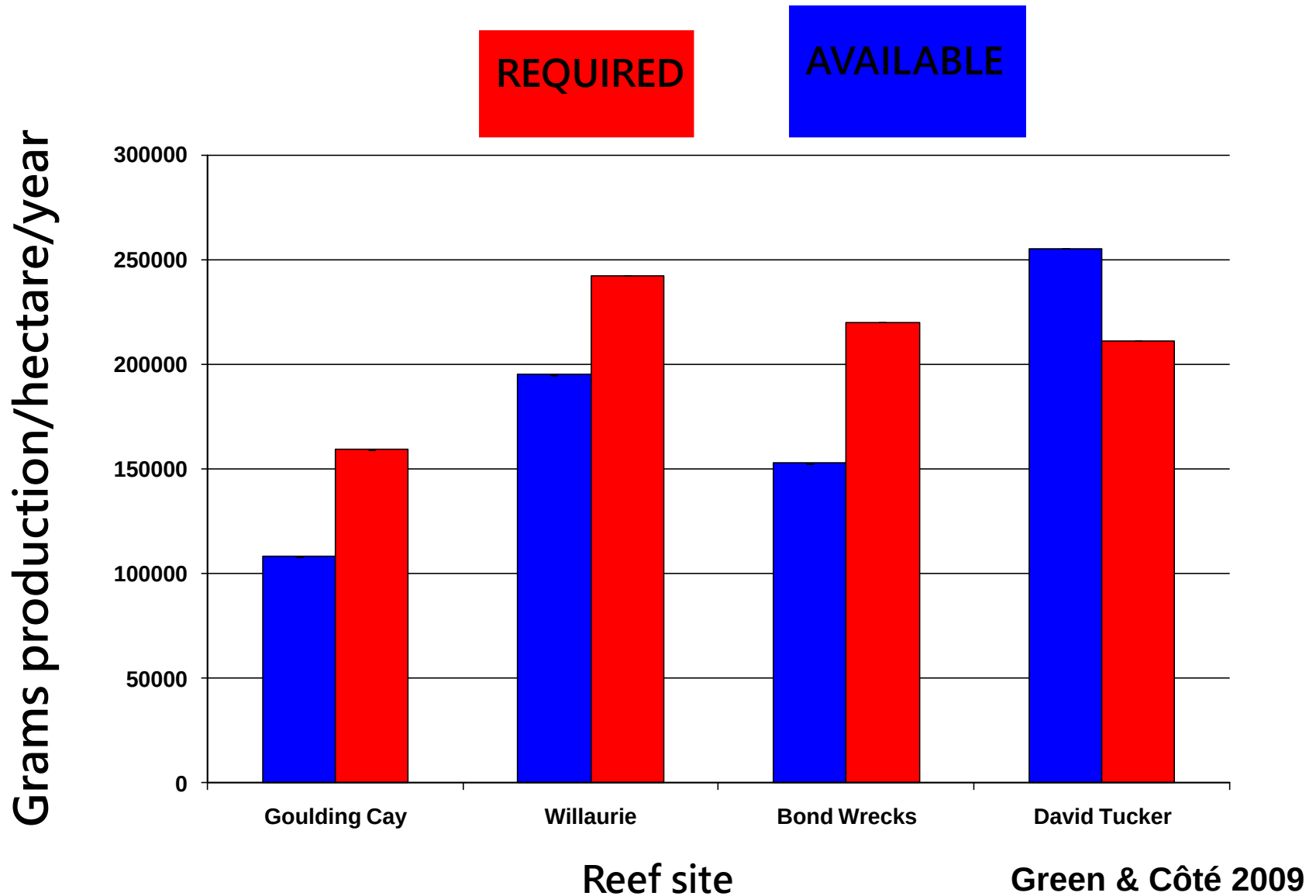
“...the majority of the prey [of lionfish] are small-bodied fish (3–5 g body weight), like damselfish, cardinal fish, and anthiases, it is estimated that... [80 lionfish in 1km of reef] will consume over 50, 000 fish yr⁻¹. “ (625 fish per year or 2.8 kg per year)

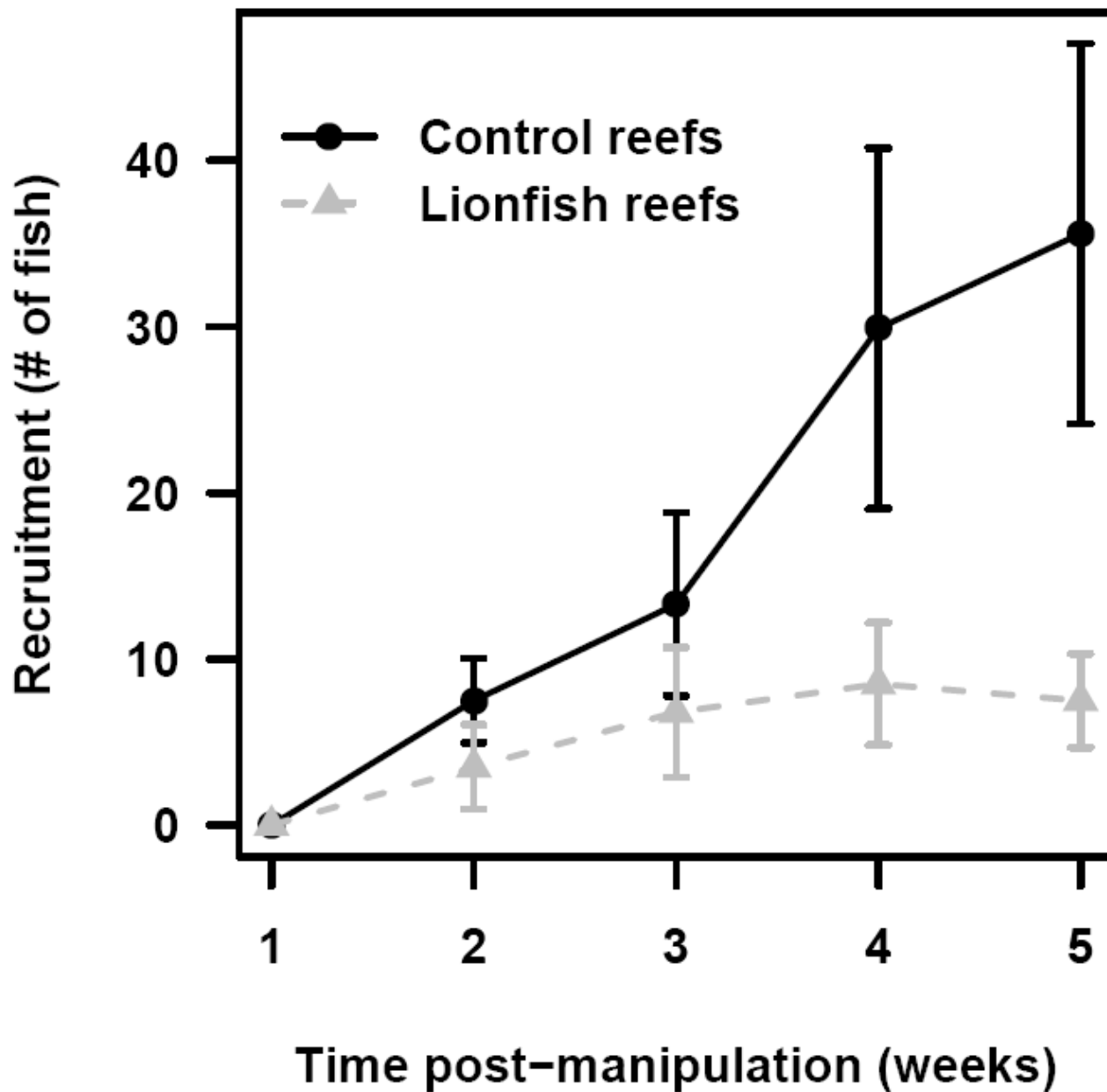
Lionfish Densities in the Invaded Range



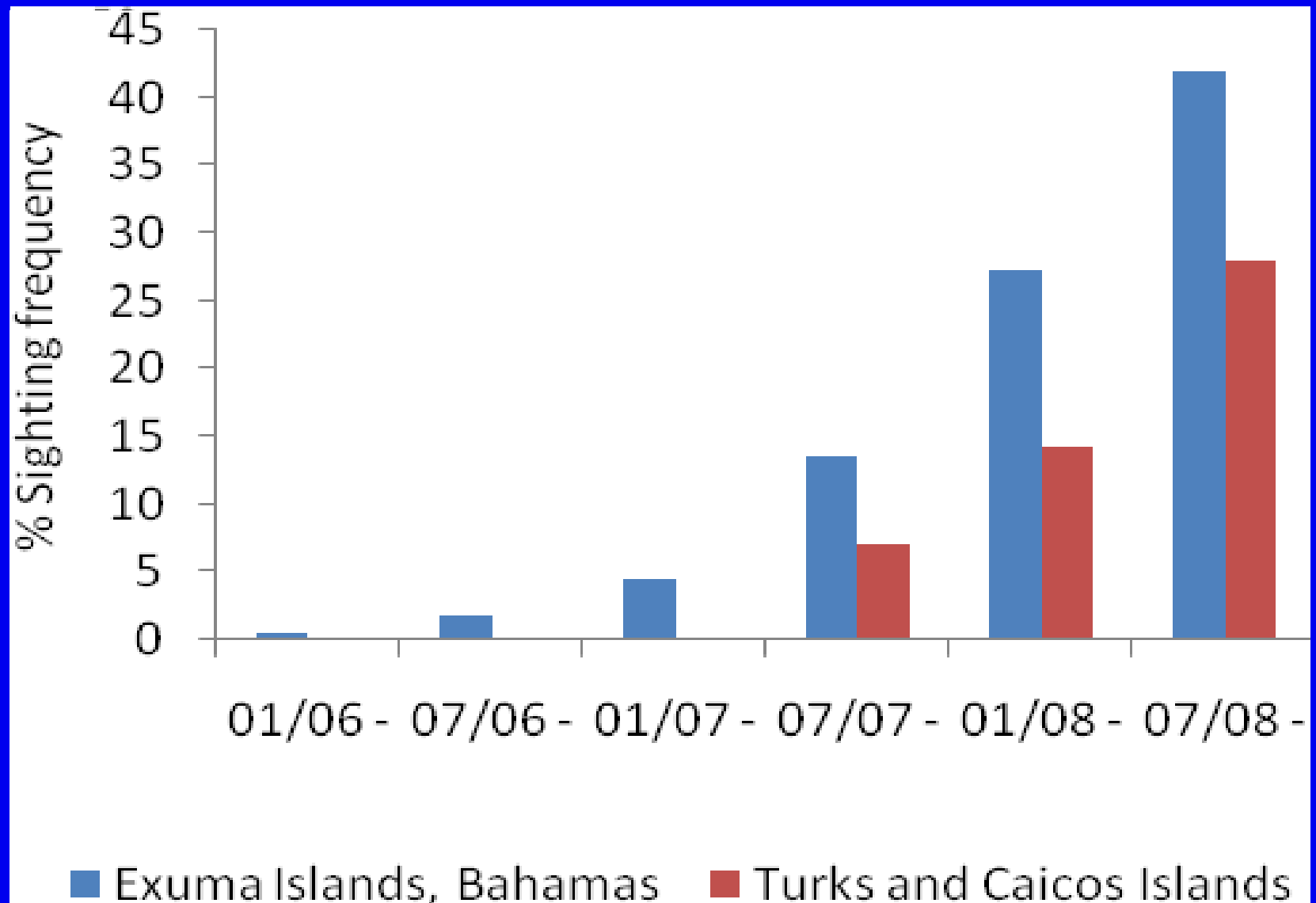
Green & Côté 2009

Lionfish prey consumption



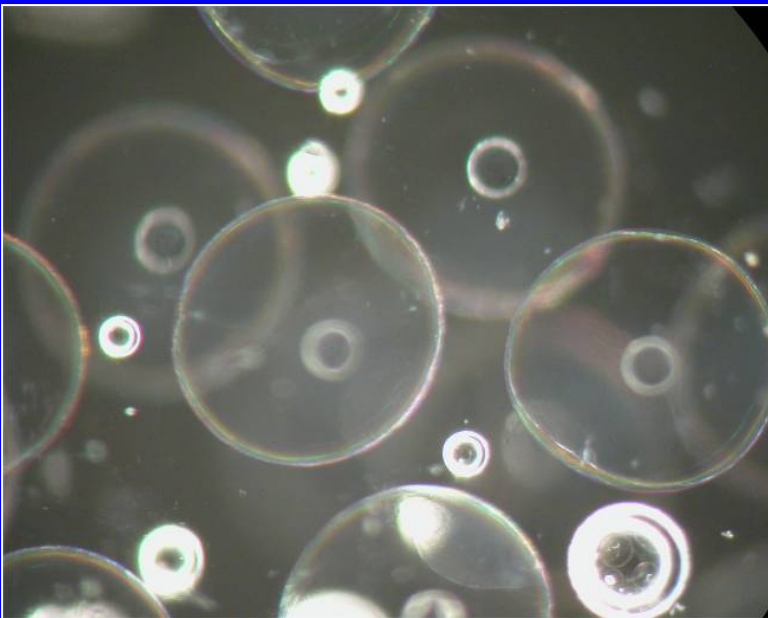


Lionfish abundance over time

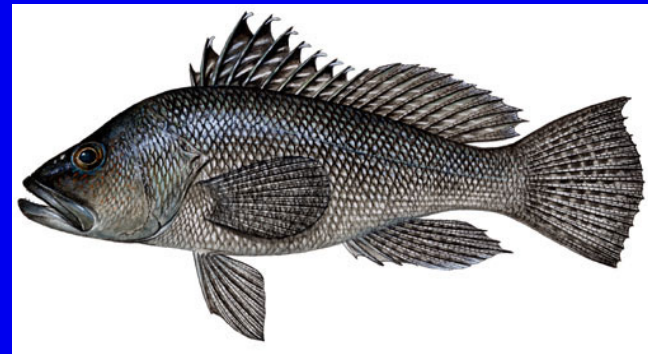
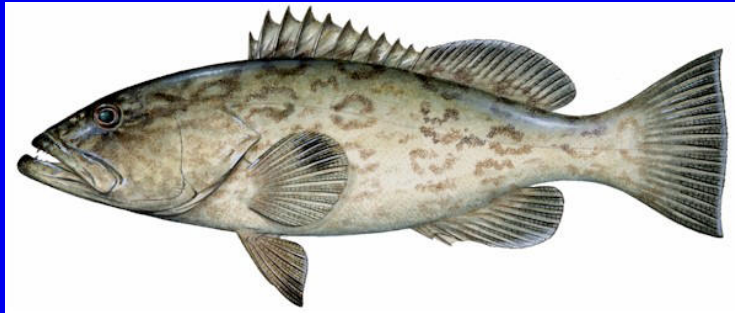
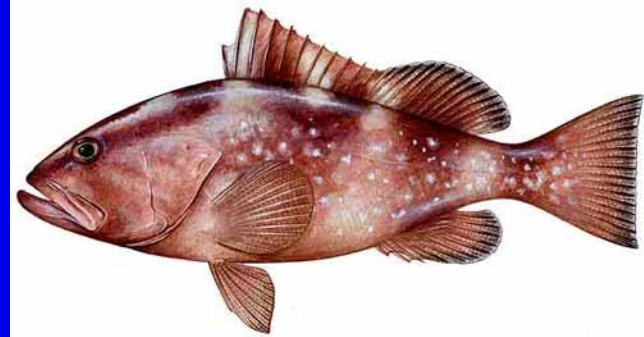


Lionfish reproduction

- .Spawn in pairs
- .Lionfish release two buoyant egg balls
- .Fecundity is ~30,000 eggs per spawn



Predation experiments





Predation on the invasive red lionfish, *Pterois volitans* (Pisces: Scorpaenidae), by native groupers in the Bahamas

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Fig. 1 Nassau grouper, *Epinephelus striatus*, with red lionfish, *Pterois volitans* dissected from stomach following capture on 5 March 2008. The lionfish was orientated in the stomach as shown



Fig. 2 Red lionfish, *Pterois volitans*, photographed on 2 March 2008 south of New Providence, Bahamas

On 26 January 2008, a tiger grouper, *Mycteroperca tigris* (472-mm standard length [SL]), was caught off New Providence (25°04.6'N, 77°20.6'W), Bahamas and found to contain a single red lionfish, *Pterois volitans* (61-mm SL) in its stomach. This observation was considered an anomaly given both the venomous nature of lionfish, and their relatively recent introduction to the Bahamas (Snyder and Burgess 2007).

Anecdotal evidence provided by fishers, however, suggested that native grouper species were preying on red lionfish with some regularity. Subsequently, five Nassau groupers, *Epinephelus striatus*, caught off Eleuthera Island (25°10.0'N, 76°14.0'W) at an approximate depth of 14 m on 5 March 2008, were dissected. Two of the stomachs contained red lionfish. The first grouper (477-mm SL) contained a partially digested lionfish, identifiable only by the morphology and multiplicity of the remaining fin rays. The second slightly larger grouper (482-mm SL) contained a red lionfish of 137-mm SL which was in almost pristine condition (Fig. 1).

The successful invasion and establishment of the piscivorous red lionfish in western Atlantic waters (Fig. 2) (Whitfield et al. 2002; Snyder and Burgess 2007) have lead to concerns over its potential impact on native fish biotas. To our knowledge, this is the first documented evidence of introduced red lionfish being preyed upon by native species within their novel range.

Acknowledgments We thank Marco Fox and Johran Hanna, Sally Thomson and Stuart Cove's Fin Photo provided Figures 1 and 2. This study was supported by a Sidney Hogg Memorial Scholarship to A. Maljković.

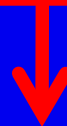
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- Snyder DB, Burgess GH (2007) The Indo-Pacific red lionfish, *Pterois volitans* (Pisces: Scorpaenidae), new to Bahamian ichthyofauna. *Coral Reefs* 26:175
- Whitfield PE, Gardner T, Vives SP, Gilligan MR, Courtenay Jr WR, Ray GC, Hare JA (2002) Biological invasion of the Indo-Pacific lionfish *Pterois volitans* along the Atlantic coast of North America. *Mar Ecol Prog Ser* 235:289–297



Lionfish Control

- Resource protection goals
- Where you are in the invasion process
- Resources (human, fiscal, logistical, etc)



PLAN OF ACTION



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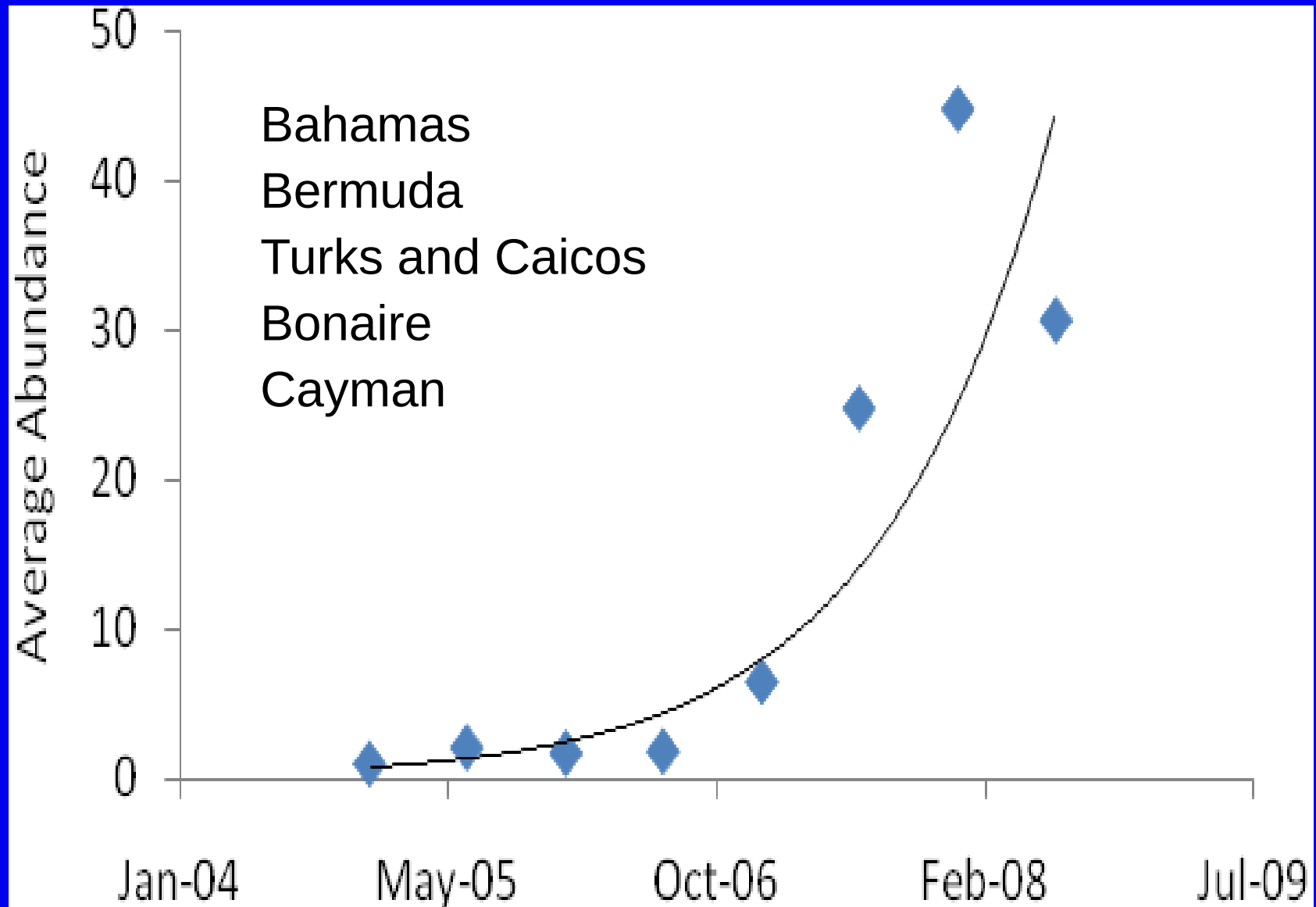
Early Detection, Rapid Response, and Removal Workshops in the Caribbean



Lionfish Workshops

- **Bahamas – Nov 08**
- **Turks and Caicos – Feb 09**
- **Cayman Islands – March 09**
- **Bonaire – April 09**
- **Belize - June 09**

Other regional examples



Initial Stages of Invasion

Early detection/rapid response framework:

- Awareness and education
- Training
- Reporting
- Responding
- Documenting





NOAA

Science for Coastal Communities

Center for Coastal Fisheries and Habitat Research
CCFHR

Early Detection and Rapid Response for Marine (Fish) Invaders in South Florida



*James A. Morris, Jr. (NOAA)
Lad Akins (REEF)
Pam Schofield (USGS)*

ED/RR Events Since Workshop (June 2008)

Date	Species	Location
JUN 15	Orbicular batfish	Key Biscayne, FL
JUL 6	Sailfin tang	Dania Beach, FL
AUG 8	Sweetlips	Palm Beach, FL
OCT 22	Pacu	Indian River Lagoon, FL
NOV 23	Raccoon butterfly	Palm Beach, FL
DEC 6	Sailfin tang	Palm Beach, FL

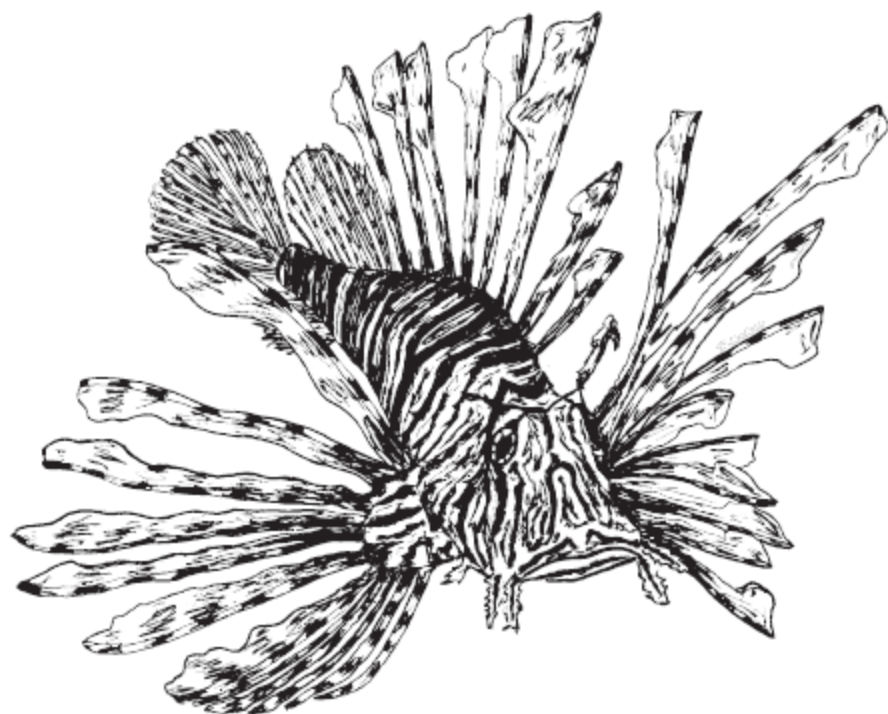


2 erroneous lionfish reports (sea lion, lizard fish)

ED/RR Events Since Last mtg (Dec 2008)

Date	Species	Location
Dec 11	Lionfish	Pompano Bch, FL
Dec 21	Lionfish	Blue Heron Bridge, FL
Dec 30	Lionfish	Key Largo, FL
Dec 31	Brushtail tang	Ft Lauderdale FL
Feb 2006	Lionfish	Barbados
Jan 6	Lionfish	Key Largo, FL
Jan 8	Lionfish	Tavernier, FL
Jan 8	Lionfish	Big Pine Key, FL
Dec 15	Masked Bannerfish	West Palm Beach, FL
Feb 14	Yellowband angelfish	Palm Beach FL
March 2	Lionfish	Tavernier, FL
1952	Lionfish	Gulf of Mexico
March 10	Lionfish	Islamorada, FL
March 11	Lionfish	Key Largo, FL
March 14	Lionfish	Key west, FL
March 14	Lionfish	Key west, FL
March 17	Lionfish	Key Largo, FL
March 24	Lionfish	Key Largo, FL





INVASIVE LIONFISH

**Report All
Sightings**
Note Location

REPORT SIGHTINGS TO



(305) 852-0030 www.reef.org/lionfish

WANTED EXOTIC SPECIES

INTRODUCED = INVASIVE = NON-NATIVE = ALIEN = NON-INDIGENOUS = EXOTIC

WHAT IS AN EXOTIC SPECIES?

These are all terms used to describe organisms living in areas beyond their natural range whose introduction was caused directly or indirectly by humans. It is illegal to release non-native species into state waters. Despite this, exotic species are on the rise throughout the state. This includes several species of non-native reef fishes, such as those pictured here. While they may look pretty, these fish are not welcome additions to our reefs.



Emperor angelfish, native to the Indo Pacific has been sighted off Pompano Beach, FL.

WHY ARE EXOTIC SPECIES HARMFUL?

Exotic species are widely regarded as one of the top threats to the maintenance of ecosystem health. They thrive in their "new" home because of a lack of predators and an abundance of prey that are ill-suited to defend themselves against the invader. When an exotic species thrives, it often competes with native species for resources such as food and shelter. This competition can result in the decline of native populations. Exotics can also introduce new parasites and diseases to the ecosystem. The U. S. Geological Survey places exotic species as the third most responsible factor for



The red lionfish native to the Indo Pacific, has been sighted from New York to Florida.

dramatic declines in biodiversity. It is important for these species to be detected early because once established, they are difficult to remove without further damaging the ecosystem. The cost of removing an exotic species can be quite high; it is estimated that it costs the U. S. economy \$1 billion a year to remove and mitigate the effects of exotic species on aquatic ecosystems (College of Agriculture and Life Sciences, Cornell University).

EXOTIC APPREHENDED

On April 27, 2000, two orbicular batfish (*Platax orbicularis*) were collected from

Molasses Reef off the coast of Key Largo, Florida.



Orbicular batfish

Normally found in the Pacific Ocean, these fish were most likely released into the wild by home aquarium owners after they grew too large for their tanks. The batfish are often seen with the native Atlantic Spadefish. In removing these intruders, REEF, the Florida Keys National Marine Sanctuary, Dynasty Marine, Inc., and the New England Aquarium launched a cooperative effort to preserve reef health in the Florida Keys. The batfish are now on exhibit in the New England Aquarium as "poster fish" for the dangers of exotic species in coral reef environments.



SPREAD THE WORD
KEEP OUR MARINE
ECOSYSTEMS
HEALTHY.



VISIT www.reef.org/exotic TO REPORT AN EXOTIC SPECIES SIGHTING





Pet Amnesty Day – Miami Metro Zoo

March 21, 2009





NOAA

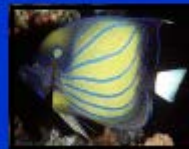
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Early Detection



Field Guide to the Non-native Marine Fishes of Florida



Schofield, P. J., J. Morris, Jr. and L. Akins



Line (Fish)



Pam Schofield (USGS)



Future efforts:

- 1) Distribute field guide
- 2) Conduct FL Keys ED/RR workshops
- 3) Removal effort research and awareness in PR/USVI
- 4) Tagging studies (acoustic and visual)
- 5) Trapping studies

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Questions?

